<1> Sociology

Class Schedule: Tuesday, 1st. (2 credits) Category: Expansion Subjects-Social Sciences
Course Code: CB21235 Instructors: LIU Jing

1. Class Subject

Education and Sustainable Development Goals (SDGs)

2. Object and Summary of Class

The 2030 Agenda for Sustainable Development, which was adopted by the United Nations in 2015, has become a shared blueprint for peace and well-being of all human beings and the planet. Education, either as a goal and a means for achieving the global goal for sustainable development, has been given special attention by the global society.

This course provides a platform for participants to reconsider the relationship between education and sustainable development goals. It starts with an introduction to history and basic knowledge of sustainable development goals (SDGs) for global development by 2030. Then, it moves to understand the educational perspectives of the SDGs in global context, particularly in Asia. In the third part of the course, it discusses achievement and challenges of education and SDGs in diverse contexts in Asia. It closes by making group blueprints for education development in/for the SDGs in Asia by participants.

3. Goal of Study

Objectives of this subject are to enable students to:
1. obtain knowledge of sustainable development goals for the global society by 2030.
2. have a more comprehensive and more in-depth understanding of the relationship between education and sustainable development in the global community and the Asian context.
3. reconsider critically about the current policies and practices of education in/for sustainable development
4. raise blueprints for educational development in/for SDGs in Asia.

4. Contents and Progress Schedule

The class will basically be conducted through Google Meet. The lecturer will inform students in advance if any face-to-face activities are necessary.
Google Classroom Class Code: 37rble6
Reading materials and handouts will be uploaded to Google Classroom.
The first class will be at 8:45 on Oct.6, 2020.
Those who cannot join this class online, please contact Dr. Jing Liu at jing.liu.e8@tohoku.ac.jp in advance.
The contents and schedule are as shown below, but subject to change depending on progress and other circumstances.
Session 1: Orientation & Introduction to Sustainable Development Goals (SDGs): A historical review
Session 2: Introduction to Sustainable Development Goals (SDGs): Understanding 17 SDG Goals
Session 3: Introduction to SDG 4
Session 4: Equitable quality education & SDGs
Session 5: Life-long learning & SDGs
Session 6: Teachers' education & SDGs
Session 7: Group presentation: Inclusive and equitable quality education in Asia
Session 8: Higher education & SDGs
Session 9: Group discussion: Transforming teaching and learning for sustainability
Session 10: SDG 4 in the post COVID-19
Session 11: Educational aid & SDGs
Session 12: Guest speaker: Education & Development
Session 13: Japan's practices in promoting SDG4
Session 14: Achievement & challenges of education development in/for SDGs
Session 15: Final presentation: How can we contribute to SDGs through education?

5. Evaluation Method

Participation (50%); Group works (30%); Reports (20%)

6. URL

1. United Nations (2015) Transforming our World: The 2030 Agenda for Sustainable Development. New York: United Nations. (https://sustainabledevelopment.un.org/post2015/transformingourworld/publication)
2. UNESCO (2019) Global Education Monitoring Report 2019: Migration, Displacement and Education. Paris: UNESCO. (https://unesdoc.unesco.org/ark:/48223/pf0000265866)

7. Preparation and Review

1.The session time is limited and therefore self-directed learning is important. Students are required to prepare and review for each class.
2. Students are encouraged to collect information and topics related to the content of the class using newspapers, books, internet and other media.
3. Group-based study and discussion are highly recommended.

8. Students must bring their own computers to class

Students may need to bring their own laptops for face-to-face discussion/activities. Announcement will be made in advance.

9. In Addition

1.Materials are provided via Google Classroom.
2. Positive participation in classes is expected.
3. If you have to be absent from class, you must notify the lecturer in advance.
4. Office hours are from 13:00 to 15:00 on Tuesdays. Make an appointment in advance via e-mail or other means. The contact information for the lecturer will be given in class.

<2> History and Human Society

Class Schedule: Wednesday, 1st. (2 credits) Category: Core Subjects-Social Studies
Course Code: CB31223 Instructors: Manabu NAKAGAWA

1. Class Subject

History of Tohoku University

2. Object and Summary of Class

What sort of a university is Tohoku University?
This course covers the history of Tohoku University to help students understand the characteristics of this University from a historical perspective.

3. Goal of Study

The goal is for each of you to acquire the following knowledge and abilities through this course.
(1) To be able to understand and explain Tohoku University's history by using some concrete example.
(2) To be able to survey and describe the features of your university, department and laboratory from a historical point of view.

4. Contents and Progress Schedule

This course is centered on a lecture. This class will use Internet School of Tohoku University (ISTU).

The contents and schedule are as shown below:

(1) Introduction
(2) Academic City Sendai
(3) The Foundation of Tohoku Imperial University
(4) Open Door Policy
(5) Establishment of University Library
(6) Development of University I
(7) Development of University II
(8) Student Life
(9) International Students
(10) World War II and Tohoku university
(11) Postwar Reforms
(12) University Campuses
(13) University Reforms
(14) University Ideals
(15) Historical Features of Tohoku University

5. Evaluation Method

Half of your grade will be based on attendance and understanding of the course (Minute Paper*, 50%), while the other half will be based on the final report (50%).
*Students will be requested to complete the Minute Paper at the end of the class.
A student absent more than 5 sessions will not be given any credit.

6. Textbook and References

No textbooks will be used. References are handed out at every class. Materials are provided via ISTU.

7. URL

8. Preparation and Review

Students will be requested to write a short essay after each class.
Students will be requested to write the final report at the end of the semester.

9. Practical business

10. Students must bring their own computers to class

No

11. In Addition

You must attend the first class session.

<3> Physics A

Class Schedule: Tuesday, 3rd. (2 credits) Category: Expansion Subjects-Physics
Course Code: CB23242 Instructors: Takeshi KOIKE *This class is open for AMB students only.

1. Class Subject

Introductory Physics

2. Object and Summary of Class

This course is intended for students without any or little backgorund in physics and calculus. Through Newtonian mechanincs, improtant concepts in physics such as force, momentum, energy, angular momentum, and laws of conservation will be introduced. In addition, how these concepts are described in the language of mathematical equations, in particular, using calculus will be explored.

3. Goal of Study

By the end of the course, you are expected to gain familiarity with Newton's laws of motion, momentum, and energy, and angular momentum as well as their conservation properties. In addition, you are expected to be able to draw a free-body diagram, derive an equation of motion, and solve it using simple vector algebra and calculus.

4. Contents and Progress Schedule

Schedule of the course:
0. Orientation to WileyPlus + ORION system and the course survey
1. Introduction and Ch1: Measurement (unit)
2. Ch2. Motion Along a straight line (acceleration and free fall)
3. Ch3. Vectors
4. Ch4: Motion in Two and Three Dimensions (Projectile motion under uniform gravity)
5. Ch4. Motion in Two and Three Dimensions (Uniform circular motion, and relative motion)
6. Ch5: Force and Motion I(Newton's law of motion)
7. Ch5 and Ch6: Force and Motion I & II (free body diagram, frictional force, and centripetal force)
Midterm examination (Ch1-Ch6)
8. Ch7: Kinetic Energy (transformation and transfer of energy, work, work done by gravity, work done by spring, and power)
9. Ch7: Kinetic Energy (transformation and transfer of energy, work, work done by gravity, work done by spring, and power)
10. Ch8: Potential Energy (isolated system, conservation of energy, conservative force and potential energy)
11. Ch9: Center of Mass (a system of particles, center of mass, conservation of total momentum of a system)
12. Ch10: Rotation (coresspondance between linear and angular motion, moment of inertia, angular momentum)
13. Review and course survey

Final examination (Lecture 7-10)

5. Evaluation Method

Evaluation will be based on a midterm exam (25%), final exam (25%), homework assignments (20%), attendance (10 %), reading assignemnt and self-practice with ORION system (20%).

6. Textbook and References

Fundamentals of Physics Extended, 10th Edition David Halliday, Robert Resnick, Jearl Walker Wiley 2013 textbook

7. URL

https://www.wileyplus.com/

8. Preparation and Review

This course requires purchase of the WileyPlus system which costs $40 USD. The system includes an electronic version of the required textbook with many integrated features to facilitate understanding of the subjects and problem solving skill in physics. The system also comes with a self-diagnostic tool, ORION, with which one will practice problem solving based on his/her own proficiency in each chapter that will be covered in the course. Access to internet is necessary outside of the class. Registration to the WileyPlus and payment method will be announced in the orientation in the first lecture.

9. Practical business

10. Students must bring their own computers to class 不要

11. In Addition

If you are planning to take Physics B or/and C, you must register for another Physics A (ZDN-PHY111E), which is targeted for chemistry and engineering majors with highschool-level physics and calculus background. Survey of conceptual understanding of the subject will be conducted at the first and last lecture to assess the effectiveness of the instructional method.

<4> Physics A

Class Schedule: Friday, 4th. (2 credits) Category: Expansion Subjects-Physics
Course Code: CB54207 Instructors: Takeshi KOIKE *This class is open for AMC and IMAC-U students only.

1. Class Subject

Classical Mechanics

2. Object and Summary of Class

This is an introductory course to Newtonian mechanics, but also serves as an introduction to the way we try to understand various natural phenomena encountered in Physics B (oscillations and waves, fluid dynamics) and Physics C (electromagnetism). Mechanics deals with motion of a physical body as well as response to forces applied to the body. The mechanics we study in this course is applicable to an object or system of particles that is slow moving in comparison to the speed of light (non relativistic) and large enough in physical scale as to be unaffected by quantum fluctuations, hence the name“classical".

3. Goal of Study

By the end of the course, you are expected to gain familiarity with and obtain basic understandings of Newton's laws, work and energy, conservation of energy, linear momentum, and angular momentum, systems of particles, rotations, and Newton's law of gravitation with Kepler's law of planetary motions.

4. Contents and Progress Schedule

Schedule of the course:
0. Orientation to WileyPlus + ORION system and the course survey
1. Ch3: Vectors (General introduction to physics, scalar vs vector, addition, dot and cross product, unit vector, and vector and calculus)
2. Ch4: Motion in Two and Three Dimensions (Projectile motion under uniform gravity, uniform circular motion, and relative motion)
3. Ch5: Force and Motion I(Newton's law of motion, its applicability, Galilean relativity, inertial frame, force and rate of change of linear momentum, and conservation of momentum)
4. Ch6: Force and Motion II (free body diagram, frictional force, drag force (viscous and inertial), and centripetal force)
5. Ch7: Kinetic Energy (transformation and transfer of energy, work, work done by gravity, work done by spring, and power)
6. Ch8: Potential Energy (isolated system, conservation of energy, conservative force and potential energy)
7. Ch9: Center of Mass (a system of particles, center of mass, conservation of total momentum of a system, and reduced mass of two body system)
Midterm (Lecture 2-6)
8. Ch9: Collision (impulse, elastic and inelastic collision, and rocket equation)
9. Ch10: Rotation (coresspondance between linear and angular motion, moment of inertia, parallel and orthogonal axis theorem, center of mass and gravity)
10. Ch11: Rolling, Torque, and Angular Momentum (rigid body, torque as a rate of change of angular momentum, torque in the center of mass frame, rolling on an inclined plane)
11. Ch11 (rolling on a flat surface, physics of tops, precession, and gyroscopic effect)
12. Ch13: Gravitation (central force, effective potential, constant of motion, Kepler's law of planetary motion)
13. Ch13: Gravitation (gravity near the earth surface, gravitational potential) and Course survey

Final examination (Lecture 7-13)

5. Evaluation Method

Evaluation will be based on a midterm exam (30%), final exam (30%), homework assignments (20%), reading assignment and self-practice with ORION system (20%).

6. Textbook and References

Fundamentals of Physics Extended, 10th Edition David Halliday, Robert Resnick, Jearl Walker Wiley 2013 textbook

7. URL

https://www.wileyplus.com/

8. Preparation and Review

This course requires purchase of the WileyPlus system which costs $40 USD. The system includes an electronic version of the required textbook with many integrated features to facilitate understanding of the subjects and problem solving skill in physics. The system also comes with a self-diagnostic tool, ORION, with which one will practice problem solving based on his/her own proficiency in each chapter that will be covered in the course. Access to internet is necessary outside of the class. Registration to the WileyPlus and payment method will be announced in the orientation in the first lecture.

9. In Addition

For those planning to take Physics B or/and C, the WileyPlus account that is purchased in this course will be reserved, and no additional payment is necessary. Survey of conceptual understanding of the subject will be conducted at the first and last lecture to assess the effectiveness of the instructional method.

<5> Life and Nature

Class Schedule: Tuesday, 2nd. (2 credits) Category: Core Subjects-Science Studies
Course Code: CB13218 Instructors: Yumiko WATANABE, etc.

1. Class Subject

Life and Nature: Dynamics of the Earth-The evolution of the universe, the earth, and life

2. Object and Summary of Class

This course aim to provide an overview of the natural processes that occurred over 13.7 billion years. In this year the course would focus on the topic, "Dynamics of the Earth" taught by instructors from School of Science, etc. An important ambition is to help students in various fields appreciate the importance, interdependence and connections between physical, chemical, biological, and social sciences. The course will provide a broad perspective about the fantastic growth in complexity in the universe and on the Earth throughout their history.
Students will explore the origin of our universe, of stars and of our own solar system and home planet. This will be followed by an overview of ideas about the origin of life on earth and a survey of the intricate connectivity between living organisms and our planet, leading to massive diversification and evolution, eventually to human development. This course will motivate the students to think about the larger issues and challenges in science and technology. The course will also highlight our current knowledge based on scientific evidence, introduce how scientific ideas evolve, and address some of the remaining big and unsolved questions. We may explore how the appearance of humans gave the enormous impact on our planet.

3. Goal of Study4. Contents and Progress Schedule

Class schedule and contents (temporal):
1) Oct. 5: Guidance
2) Oct. 12: A special class with Japanese students in the "Big History" course: What is Big History?
3) Oct. 13: Evolution History of Solar System (Dr. Daisuke Nakashima)
4) Oct. 20: Origin of Solar System (Prof. Bill McDonough)
5) Oct. 27: Origin of the Earth (Prof. Bill McDonough)
6) Nov.10: Difference in Rocks on Continents and Ocean Floor (Prof. Bill McDonough)
7) Nov. 17: Earth Energy (Geothermal Energy) + Resources (Prof. Bill McDonough)
8) Nov. 24: Plate Tectonics 1 (Assis. Prof. Pastor-Galan Daniel)
9) Dec. 1: Plate Tectonics 2 (Assis. Prof. Pastor-Galan Daniel)
10) Dec. 8: The Origin of Life (Assoc. Prof. Yoshihiro Furukawa)
11) Dec. 15: Environmental and Biological Evolution (Prof. Yumiko Watanabe)
12) Dec. 22: Dynamics of Solid Earth (Assoc. Prof. Satoshi Okumura)
13) Jan. 5: Mineralogy and Crystallography (Assoc. Prof. Takahiro Kuribayashi)
14) Jan. 19: A special class (TBA)
15) Feb. 1: A special class with Japanese students in the "Big History" course: Discussion about Future Earth

5. Evaluation Method

Evaluation will be based on weekly attendance (30%) and active participation in discussion sessions (20%), homework assignments & reports (50%).

6. Textbook and References

7. URL

1. Big History Project web site: https://school.bighistoryproject.com/bhplive
2. Cosmic evolution. Eric J. Chaisson (2013) https://www.cfa.harvard.edu/~ejchaisson/cosmic_evolution/docs/splash.html
3. The History of Earth: https://www.youtube.com/watch?v=pN7VQas4OgQ
4. Cosmology Today: https://www.youtube.com/watch?v=xyhZcEY5PCQ

8. Preparation and Review

Students will be expected to spend about 1-2 hours per week, on average, reviewing video and doing assignments.

9. Students must bring their own computers to class

Yes, a computer or other device (tablet, smart phone).

10. In Addition

1) It is a required course for all first-year FGL program students, and also is open to all students. Japanese students and exchange students may be enrolled.
2) Classes will be given remotely with different styles like "on demand", "interactive online session" using a different type of platform, such as Zoom, Meet. Many classes are taught by instructors from Dept. of Geosciences.
3) Instructor, Yumiko Watanabe, is available for questions and consultation upon appointment and during office hours (TBA) (yumiko.watanabe.a5@tohoku.ac.jp).

<6> Biology A

Class Schedule: Monday, 2nd. (2 credits) Category: Expansion Subjects-Biology
Course Code: CB22244 Instructors: Yuichiro NAKAJIMA, etc.

1. Class Subject

Essential Cell Biology

2. Object and Summary of Class

Cells are the structural and functional units of living organisms. Understanding basics of cell biology is essential for studying all areas of life sciences and any related branches of natural sciences. The main objective of this course is to learn the essential principles of cell biology by learning how the living cells are made and operated from a molecular perspective: especially, how DNA, RNA and proteins cooperatively work inside the cells to allow the maintenance, replication and responses to stimuli. This course particularly emphasizes the storage and utilization of genetic information in cells through the processes, "the central dogma".

3. Goal of Study

Upon finishing this course, students will have a solid grasp of cell structure and molecular dynamics during DNA replication and repair, gene expression, and cellular communication. To accomplish this goal, students need to understand the basic of cellular components, chemical reactions, and information processing mechanisms, and signaling systems. In addition, by applying the concept of cell biology, students will learn more about living organisms including humans and will have a glimpse of cutting-edge sciences.
Some of the specific learning objectives include:
- Understand fundamental roles of cells in living systems
- Realize the importance of studying cells in order to understand living organisms, and ecosystems as well as human health and disease.
- Explain the fundamental differences between prokaryotic and eukaryotic cells from both a structural and evolutionary perspective
- Understand the function of the main cellular and genetic components, how
they are connected to the living process
- Describe the basic mechanisms involved in DNA replication and repair, gene expression (transcription and translation)
- Explain the basic idea of gene and genome evolution
- Understand principles of cell signaling and information processing
- Understand the system of cell communities by integrating cellular and molecular processes

To achieve this, students will complete weekly reading and problem-set assignments. Quizzes and in-class exercises, and an online forum will be used to promote co-learning and interactions between students. In addition, a final examination will be used to evaluate student learning and ability to extend what they learned in novel contexts.

4. Contents and Progress Schedule

1) Introduction
2) Cells as the fundamental units of life
3) Chemical components of cells
4) Chemical reactions in cells
5) DNA and chromosomes (structure and function)
6) DNA replication, repair, and recombination
7) From DNA to RNA (transcription and RNA processing)
8) From RNA to proteins (translation and protein synthesis)
9) Control of gene expression 1 (transcriptional mechanisms)
10) Control of gene expression 2 (post-transcriptional controls)
11) Gene and genome evolution
12) Cell signaling 1 (principles and concepts)
13) Cell signaling 2 (receptors and cell-cell communication)
14) Cell communities (tissue, stem cells, and cancer) + Exam information
15) Final examination

5. Evaluation Method

Attendance and active participation (30%), homework assignments (20%), weekly in-class quizzes, exercises and mini-presentation (20%), examinations (30%).

6. Textbook and References

Essential Cell Biology, 4th Edition Alberts B, Bray D, Lewis J, Raff M, Walter P, Hopkin K, Johnson A, Roberts K Garland Science 2014
Essential Cell Biology, 5th Edition Alberts B, Hopkin K, Johnson A, Morgan D, Raff M, Roberts K, Walter P WW Norton & Co 2018

7. Preparation and Review

Students are expected to spend 2-3 hours per week, reading relevant textbook material, preparing for the class and completing online assignments.

8. Students must bring their own computers to class

A computer or other device is necessary for this online course.

9. In Addition

1) This is a general, entry-level biology course, open to all students and compulsory for first-year FGL students in the AMB program. High school-level familiarity with basic organic chemistry and biology is expected, but not necessarily. Japanese students and exchange students from any field of study are encouraged to enroll, knowing that this is an introductory course held in English.
2) Essential Cell Biology (4th or 5th Edition) is the main reference textbook.
3) Instructors are available for questions and consultation upon appointment.
e-mail: yuichiro.nakajima.d2@tohoku.ac.jp

<7> Chemistry A

Class Schedule: Wednesday, 2nd. (2 credits) Category: Expansion Subjects-Chemistry
Course Code: CB32218 Instructors: ZHANPEISOV, Nurbosyn

1. Class Subject
Fundamentals of chemical bond theory

2. Object and Summary of Class
The nature of chemical bond is the fundamental concept to understand the structure and properties of atoms and molecules as well as any molecular substances. One will learn the electronic structure of atoms depending on its position in periodic table of elements, formation of bonds as well as different molecular associations based on quantum chemistry concepts.

3. Goal of Study
One must understand the structure of the atom based on its electronic configuration as well as its relationship with chemical and physical properties of any element. One will learn the concept of wave equation, its application to diatomic molecules and chemical bonds in large molecular associations. Shape or structure of simple polyatomic molecule can be explained via concept on hybridization or hybrid molecular orbital formation as well as relationships between bond length and electronic configuration. One must understand the nature of bonding responsible for stability of molecular associations.

4. Contents and Progress Schedule
1. Introduction
2. Classical quantum theory and atomic model
3. Wave equation and basics of quantum chemistry
4. Electronic configuration and periodic table of elements
5. Covalent bond and ionic bond
6. Electronic structure of positively charged molecular hydrogen and diatomics
7. Hybrid molecular orbital and the shape of the polyatomic molecule
8. Molecular complexes and intermolecular forces
9. Crystal structure motif and crystal field theory
10. Approximation methods, Valence-bond (VB) method
11. Hueckel theory for ethylene, allyl
12. Hueckel theory for butadiene and trimethylenemethane
13. Applications to complex organic molecules
14. Modern quantum chemistry
15. Term-end test

5. Evaluation Method
Evaluation will be based on class attendance, reports and on the results of term-end test.

6. Textbook and References
Physical Chemistry Ira N. Levine 2008
Physical Chemistry: A Molecular Approach D.A. McQuarrie and J.D. Simon 2011

7. URL

8. Preparation and Review
Basic knowledges on STEM subjects for high-school level is needed.

9. Practical business

10. Students must bring their own computers to class
No

11. In Addition
We will have small and term-end tests. The lecture attendance will be strictly controlled.

<8> Mineralogy, Petrology & Geochemistry

Class Schedule: Monday, 3rd. (2 credits) Category: Expansion Subjects-Natural Sciences/ Earth and Space Science
Course Code: CB12239 Instructors: ZHANPEISOV, Nurbosyn

1. Class Subject
Fundamentals of crystal structures of solids

2. Object and Summary of Class
The chemical crystallography applied to different kinds of solid structures is an important fundamental concept in many fields of chemistry and physics. One will learn the diversity of oxide, salt, metallic as well as organic solids, the nature and types of ordered structures composed of identical repeating units of a group or large atoms, molecules, ions as well as basic principles of defining crystal structures by physical and theoretical methods.

3. Goal of Study
One must understand different types of solids with crystalline and/or amorphous structures, a number of possible chemical bonding (driving force) in solids as well as fundamental energy units to characterize crystalline association. Also one must understand the structure-property relationship to describe tiny chemical and physical properties of any solid.

4. Contents and Progress Schedule
1. Introduction to the chemistry and physics of solids, mineralogy
2. Amorphous solid, glass and polymer (biopolymer)
3. Chemical bonding in solids, coordination number
4. Cohesive energies in solids, formation energy of a unit
5. Interatomic distances in crystal structures
6. Basic structure motifs of crystalline solids
7. Anisotropy and the Avogadro constant
8. Mid-term test
9. Magnesium oxide, low coordination ions
10. Silica and zeolites
11. Titanium dioxides (rutile, anatase, brookite)
12. Covalent crystals of carbon
13. Metals
14. Metal-organic frameworks
15. Term-end test

5. Evaluation Method
Evaluation will be based on class attendance, reports and on the results of term-end test.

6. Textbook and References
Physical Chemistry R.J. Silbey, R.A. Alberty 2000

7. URL

8. Preparation and Review
Basic knowledges on STEM subjects is needed.

9. Practical business

10. Students must bring their own computers to class
No

11. In Addition
We will have small and term-end tests. The lecture attendance will be strictly controlled.

<9> Chemistry B

Class Schedule: Thursday, 3rd. (2 credits) Category: Expansion Subjects-Chemistry
Course Code: CB43217 Instructors: ZHANPEISOV, Nurbosyn

1. Class Subject
Fundamentals of physical chemistry

2. Object and Summary of Class
In this course, main emphasize will be given to the fundamentals and concepts that provide a basis for understanding physical chemistry, underline physical principles that govern the properties and behavior of chemical systems. It would be also as a learning basic course by giving a series of lectures on different topics of physical chemistry.

3. Goal of Study
One must understand the fundamental relationships between the structure of a chemical compound and its physical (as well as chemical) properties. One must understand main concepts of state equations, main laws of thermodynamics, reaction equilibrium as well as reaction kinetics.

4. Contents and Progress Schedule
1. Quantitative concepts of temperature, work, internal energy and heat
2. Classical mechanics and Newton's second law of motion
3. First law of thermodynamics
4. Barometric formula, van der Waals equation, enthalpy and heat capacity
5. Carnot heat engine, the second law of thermodynamics
6. Entropy, the third law of thermodynamics, thermodynamic equations of state
7. Mid-term test
8. Kinetic theory of gases, model of a perfect gas
9. Types of average speeds, collision with a surface
10. Reaction kinetics and reaction rate equation
11. First, second and third order reactions
12. Reversible first order reaction, parallel first order reaction
13. Consecutive first order reaction, mechanisms of chemical reactions
14. Radical reactions, unbranched and branched chain reactions
15. Term-end test

5. Evaluation Method
Students must attend all these lectures. Evaluation will be based on class attendance, on the results of short and term-end tests, homeworks and reports.

6. Textbook and References
Physical Chemistry Ira N. Levine 2008
Atkins' Physical Chemistry P. Atkins and J. de Paula 2006

7. URL

8. Preparation and Review
Basic knowledges on STEM subjects for high-school level is needed.

9. Practical business

10. Students must bring their own computers to class
No

11. In Addition
We will have small and term-end tests. The lecture attendance will be strictly controlled.

<10> World of Fine Arts

Class Schedule: Thursday, 4th. (2 credits) Category: Core Subjects-Human Studies
Course Code: CB44208 Instructors: Mitsuru HAGA

1. Class Subject
Japanese Art History

2. Object and Summary of Class
Art shows (and encompasses) the way we comprehend and understand this Universe. Therefore Art should be regarded as a visual philosophy; not as a mere illustration of history based on written documents. Thereupon, the importance of learning its history, in this case, Japanese Art History, can never be exaggerated.

3. Goal of Study
The objective of this course is to provide an outline and basic knowledge about Japanese Art History ranging from the beginnings of human habitation in the Japanese archipelago to the present, including the art of the Jomon, Yayoi, Kofun, Asuka and Nara, Heian, Kamakura, Muromachi, Azuchi-Momoyama, Edo, Meiji, Taisho, Showa and Heisei Periods.

4. Contents and Progress Schedule
1. Course Orientation. What is Art ?
2. Art of Jomon Period
3. Art of Yayoi and Kofun Periods
4. Asuka Hakuou Art~ the Reception of Buddhism
5. Art of Nara Period
6. Ar of Heian Period 1
7. Art of Heian Perido 2
8. Art of Kamakura Period
9. Art of Nanbokucho/Muromachi Period
10. Art of Momoyama Period
11. Art of Edo Period 1
12. Art of Edo Period 2
13. Art of Meiji Period
14. Art of Taisho, Showa and Heisei Periods (1)
15. Art of Taisho, Showa and Heisei Periods (2)

5. Evaluation Method
Evaluation will be based on final report (70%), performance in the class room (30%).

6. Textbook and References
A History of Japanese Art Noritake TSUDA Tuttle Publishing 2009

7. URL

8. Preparation and Review
The session time is limited and therefore self-directed learning is important. Students are required to prepare and review for each class.

9. Practical business

10. Students must bring their own computers to class
No need.

11. In Addition

<11> Foundations of Calculus

Class Schedule: Tuesday, 4th. (2 credits) Category: Expansion Subjects-Mathematics
Course Code: CB24246 Instructors: Xavier DAHAN

1. Class Subject
Fundamental of Calculus

2. Object and Summary of Class
Built upon Calculus learnt in high-school, this course prepares to more advanced/academic techniques of essential Calculus. Differential and Integral Calculus are the core of this course.

3. Goal of Study
Learn more advanced techniques of differentiation and integration.
Learn applications of differential and integral calculus.

4. Contents and Progress Schedule
1-2. Review of function. Trigonometric functions, inverse trigonometric functions.
3. Limits. Continuity.
4. Derivative of a function. Differentiability.
5. Derivatives of usual functions. Product, quotient and chain's rules.
6. Mean value theorem. Min/max problems.
7. De L'Hospital's rule. Computation of limits.
8. Mid-term examination.
9. Integration. Definition and Fundamental Theorem of Calculus.
10. Techniques of Integration I: substitution and integration by parts.
11. Integration of rational functions.
12. Length, area, volume, average.
13. Improper integrals.
14. Review
15. Final examination.

5. Evaluation Method
Best score between:
option A (40% final + 30% midterm + 30% reports)
option B (50% final + 50% midterm)

6. Textbook and References
Thomas' Calculus M.-D. Weir. J. Hass PEarson
Calculus: an intuitive and physical approach M. Kline Dover

7. URL

8. Preparation and Review
Each new topic leanrt is accompanied by "practice sheets" that illustrate and deepen each taught material. A selection of these problems will be solved in class. A number of reports will be assigned and will serve for the score (in case of option A for grading)

9. Practical business

10. Students must bring their own computers to class
No

11. In Addition

<12> Calculus A

Class Schedule: Friday, 2nd. (2 credits) Category: Expansion Subjects-Mathematics
Course Code: CB52211 Instructors: Xavier DAHAN

1. Class Subject
Calculus of a function of the real variable (Calculus A)

2. Object and Summary of Class
This is a classical first course of calculus for engineering/physic students. It takes root in Calculucs learnt in high-school and brings it to an advanced/academic level with thorough applications.

3. Goal of Study
Learn fundamental techniques of calculus of a function of the real variable, especially differentiation and integration.
Learn basic and fundamental applications.
Raise computational skills and become confident in conducting substantial computations.

4. Contents and Progress Schedule
1-2. Introduction. Review of elementary functions. Inverse functions. Inverse trigonometric functions.
3. Limit of a sequence of numbers, definition and properties of real numbers.
4. Limit of a function and continuity. Intermediate value theorem.
5. Definition of the derivative and a function, differentiability.
6. Computations of derivatives. Mean value theorem and applications to extreme problems
7. De L'Hospital's rule and practical computations of limits.
8. Midterm examination
9. Taylor's expansions, practical computations.
10. Definition of the Riemann integral and the fundamental theorem of calculus. Length, areas, Volume.
11. Computation of antiderivatives of elementary functions.
12. Techniques of integration I: substitution and integration by parts.
13. Techniques of integration II: integration of rational functions.
14. Tecnhniques of integration III: trigonometric integrands and integral substitutions
15. Final examination

5. Evaluation Method
Best score between:
option A (40% final + 30% midterm + 30% reports)
option B (50% final + 50% midterm)

6. Textbook and References
Shaum's outline. Calculus (sixth edition) Frank ayres. Elliott MEndelson McGraw Hill

7. URL

8. Preparation and Review
Each new topic leanrt is accompanied by "practice sheets" that illustrate and deepen each taught material. A selection of these problems will be solved in class. A number of reports will be assigned and serve for the score (i n case of option A for grading)

9. Practical business

10. Students must bring their own computers to class
No

11. In Addition

<13> Linear Algebra A

Class Schedule: Tuesday, 3rd. (2 credits) Category: Expansion Subjects-Mathematics
Course Code: CB23236 Instructors: Marcin SCHROEDER

1. Class Subject
Linear Algebra A

2. Object and Summary of Class
This is a course introducing students into the mathematical discipline of linear algebra understood as a theory of algebraic structures (in this course vector spaces over the field of real numbers) and functions preserving these algebraic structures (linear mappings) together with the additional structure of real scalar product. After the first bridging class explaining the relationship between mathematical concepts learned in high school and those studied in this course, more rigorous study begins which departs from the axioms and principles to their logical consequences. Linear algebra was originally developed as a fundamental tool of other mathematical theories. Students will learn about some of the applications. of these tools. The course will be followed by another course Linear Algebra B and is the prerequisite for this course.

3. Goal of Study
Upon successful completion of the course, students will be able to solve traditional problems of linear algebra, such as solving systems of linear equations in many variables, but also they will be able to apply methods of linear algebra in other mathematical disciplines (such as Calculus) and in a wide range of applications in mathematical and natural sciences. Also, students will be prepared for the use of relevant mathematical literature in their studies and for the creative and innovative use of mathematical methods.
Although this is not directly part of the subject, the course will focus on the proper ways to express mathematical reasoning.

4. Contents and Progress Schedule
Class 1: Clarification of misunderstandings in high school exposition of relevant concepts. Review of the concepts necessary for the study in this course.
Class 2: Vectors and Vector Spaces
Class 3: Matrices and Linear Equations I
Class 4: Matrices and Linear Equations II
Class 5: Vector Spaces and their Subspaces
Class 6: Linear Mappings
Class 7: Linear Mappings and Matrices
Class 8: Composition and Inverse Mappings
Class 9: :Scalar Products and Orthogonality
Class 10:Bilinear Mappings
Class 11:Determinants
Class 12: Linear Operators
Class 13: Eigenvectors and Eigenvalues
Class 14: Diagonalization
Class 15: Final Exam

5. Evaluation Method
50% Homework
50% Final Exam

6. Textbook and References
Linear Algebra 3rd ed. Serge Lang Springer 1987

7. URL
TBA

8. Preparation and Review
The course does not require any special preparation beyond high school mathematics.
Students will be assigned homework almost every class meetings. Next class there will be discussion of the assignment followed by the lecture presenting next portion of course material.

9. Practical business

10. Students must bring their own computers to class no

11. In Addition
Textbook is available on the internet for free.
FGL students can borrow a supplementary textbook Introduction to Linear Algebra by Serge Lang from the university.

<14> Basic Japanese 1

Class Schedule: Monday, 4th/Tuesday, 5th/ Thursday, 2nd/Friday 3rd. (4 credits)
Category: Common Subjects-Subjects for International Students
Course Code: CB25226 Instructors: Natue SUGAYA, Kei YOSHIMOTO, Atsuko UCHIYAMA

1. Class Subject
Japanese for beginners

2. Object and Summary of Class
This class will use two Google Classrooms. Please enter the class codes "f5noqe5" and "7aogw5w" to join the Classrooms.
Intended for students who will study Japanese for the first time. This class aims to help students acquire basic knowledge of Japanese language and enhance the four skills of speaking, listening, reading, and writing.

3. Goal of Study
Students will
- master elementary Japanese grammar, vocabulary, kana (hiragana, katakana) and approximately 150 basic kanji
- acquire minimum skills in speaking, listening, reading and writing for essential everyday situations
- achieve a proficiency level equivalent to JLPT N5.

4. Contents and Progress Schedule
1. Course orientation, Kana quiz
2-5. Lesson 1 X wa Y desu construction, Question sentences
6-9. Lesson 2 Demonstrative (ko/so/a)
10-13. Lesson 3 Verb types and the present tense
14-18. Lesson 4 Describing where things are, Past tense of verbs
19-23. Lesson 5 Adjectives, Counting
24-28. Lesson 6 Te-form, Describing two activities
29. Midterm exam (Kanji, Grammar, Listening)
30. Midterm exam (Speaking)
31-34. Lesson 7 Various meanings of te iru form
35-39. Lesson 8 Short forms (plain forms)
40-44. Lesson 9 Past tense short forms
45-49. Lesson 10 Comparison between two items
50-54. Lesson 11 Describing hope or aspiration (-tai)
55-58. Lesson 12 Explaining things (-n desu)
59-60 Summary

5. Evaluation Method
A comprehensive evaluation will be made based on midterm andfinal exams, quizzes, homework assignments, and class participation.

6. Textbook and References
Genki 1, 3rd edition Banno et al. The Japan Times 2020 Textbook

7. URL
Genki-Online https://genki3.japantimes.co.jp/
The Japan Times, Book Club https://bookclub.japantimes.co.jp/en/book/b497763.html

8. Preparation and Review
(1)Those who have no knowledge of the Japanese characters (hiragana, katakana) should learn hiragana and katakana as a prerequisite to joining the program by using prescribed materials.
(2) During the course we expect you to:
1. Submit all homework assignments by due dates. Late work will be marked lower.
2. Prepare for the lessons: Listen audio materials and learn vocabulary in advance. Read the grammar explanations in advance.

9. Practical business

10. Students must bring their own computers to class 必要 Yes

11. In Addition
Students are required to purchase the THIRD edition of GENKI 1.